

**WHAT IS CLAIMED IS:**

1. A safety syringe assembly, comprising:

an elongated, generally cylindrical barrel having a hollow interior forming a hollow nozzle located at a distal end of said barrel and opening into the interior of said barrel and  
 5 an expanded proximal segment;

a plunger slidably mounted in said barrel and having a longitudinal open channel;  
 a needle;

a needle holder mounting said needle at a distal end thereof and slidably mounted in said longitudinal open channel of said plunger for movement between an advanced  
 10 position in which said needle on the distal end of said needle holder projects from a distal end of said nozzle, and a retracted position in which said needle is retracted within said barrel;

a compression spring mounted inside of said barrel, and a spring retainer element located in said expanded proximal segment of said barrel and having a stabilizing surface  
 15 extending along and about a portion of the internal wall of said barrel, and a spring support portion extending from said stabilizing surface interiorly of said barrel and supporting a distal end portion of said spring against expansion, said spring retainer also having a through opening for freely receiving said needle holder therethrough; said spring urging said needle holder toward its retracted position; and

20 a latch having an engaged position in which said needle holder is latched relative to said barrel to hold said needle holder in its advanced position against the urging of said spring, and a disengaged position in which said needle holder is unlatched relative to said barrel to allow said spring to expand in a proximal direction to move said needle holder to its retracted position.

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2. The syringe assembly of claim 1 wherein said latch is inseparably mounted to said barrel.

3. The syringe assembly of claim 1 wherein said spring is a helical spring  
 30 disposed around said needle and said needle holder.

4. The syringe assembly of claim 1 wherein said latch is mounted so as to be activated by advance of said plunger.

5. The syringe assembly of claim 1 wherein said latch is mounted on an external surface of the barrel.

6. The syringe assembly of claim 1 wherein said barrel includes a track slot and wherein said needle holder includes a lateral arm extending laterally from said plunger open channel into said track slot, whereby said needle holder is guided by said track slot as it moves toward its retracted position.

7. The syringe assembly of claim 6 wherein said latch is mounted for movement into and out of registry with a distal end of said track slot for capturing and releasing said lateral arm at the distal end of said track slot.

8. A retractable needle safety syringe assembly, comprising:  
a hollow generally cylindrical barrel, with a distal hollow nozzle communicating with the barrel;

a plunger slidably inserted in the barrel, having a polymeric piston at a distal end, and a longitudinal open channel;

a needle holder with a needle mounted at the distal end thereof and slidably mounted in said longitudinal open channel of said plunger for movement between an advanced position in which said needle on the distal end of said needle holder projects from a distal end of said nozzle, and a retracted position in which said needle is retracted within said barrel;

a compression spring wrapped around said needle holder;

said plunger having linear axial mobility independent of movements of the spring and needle holder;

a spring retainer located in said barrel supporting said compression spring;

a switch engaging the barrel and the needle holder and having two radial projections entering within the barrel cavity;

said plunger advancing the polymeric piston to make a surface contact of a distal conical end of the piston with a conical interior end of the barrel for injecting medicine through the needle by minimal force applied to said plunger;

said plunger being movable with an additional applied force to advance distally  
5 within a cavity formed in the piston as well as to compress the piston thereby additionally advancing distally within the barrel, a pair of plates projecting from the plunger engaging and radially displacing said projections of the switch upon said additional advance, so as to displace the switch radially outwardly causing the release and retraction of the needle holder.

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9. The assembly of claim 8 having a barrel with proximal wider segment that accommodates a spring retainer.

10. The syringe assembly of claim 8 including a needle protector, and wherein  
15 said nozzle of said barrel has a male luer taper on its outer surface that mates with a female luer taper interior of the said needle protector creating a taper lock to form an air and water tight seal between the barrel nozzle and needle protector, whereby air or fluids residing in the sealed barrel prevent advance of the plunger to the distal end of the barrel, avoiding the retraction before the use of the syringe.

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11. The syringe assembly of claim 9, wherein the switch mechanism is located outside a fluid chamber defined in said barrel, and advancement of the plunger in a fluid-filled barrel generates a hydraulic pressure gradient that is relieved by the exit of said fluid from the needle such that any increase in the hydraulic pressure in the barrel as a result of  
25 an imbalance of generation and relief of the pressures tends to prevent rather than encourage retraction of the needle.

12. The assembly of claim 11 wherein said hydraulic pressure gradient prevents accidental retraction by preventing the contact between the projecting parts on  
30 the plunger and on the latch.

13. The assembly of claim 8 wherein the spring and needle holder are located proximal to said polymeric piston mounted to a distal end of said plunger whose movements are responsible for generation of pressure and vacuum in the barrel and which is not affected by pressure gradients within the barrel.

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14. The syringe assembly of claim 8 wherein said spring is a coil spring and is sized to fit in said open channel of said plunger.

15. A safety syringe assembly, comprising:

10 an elongated, generally cylindrical barrel having a hollow interior forming a hollow nozzle located at a distal end of said barrel and opening into the interior of said barrel;  
a plunger slidably mounted in said barrel and having a longitudinal open channel;  
a needle holder slidably mounted in said longitudinal open channel of said plunger for movement between an advanced position in which a needle on the distal end of said  
15 needle holder projects from a distal end of said nozzle, and a retracted position in which said needle is retracted within said barrel;

a spring mounted inside said barrel and urging said needle holder toward its retracted position; and

a latch having an engaged position in which said needle holder is latched to said  
20 barrel to hold said needle holder in its advanced position against the urging of said spring, and a disengaged position in which said needle holder is unlatched from said barrel to allow said spring to move said needle holder to its retracted position;

wherein said latch comprises a needle holder locking element non-removably, circumferentially mounted on said barrel for rotary movement between a locking position  
25 and non-locking position on the barrel relative to said needle holder.

16. The syringe assembly of claim 15 wherein said barrel has outwardly extending gripping flanges, and one or more detent elements parallel to and axially spaced from said outwardly extending gripping flanges and said needle holder locking element is  
30 mounted between said detent elements and said barrel flanges.

17. The syringe assembly of claim 16 wherein said needle holder includes a lateral arm which extends radially through an axial elongate slot through the barrel wall and distal to said flanges, and wherein said latch is located adjacent said flanges to engage a portion of said lateral arm.

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18. The syringe assembly of claim 15 and further including a spring retaining member for supporting a distal end portion of the spring inside the barrel.

19. The syringe assembly of claim 17 and further including a retaining member  
10 for supporting a distal end portion of the spring inside the barrel, a proximal end of said spring abutting said lateral arm of said needle holder.

20. The syringe assembly of claim 15 wherein said latch has at least one inwardly projecting member extending through a wall of said barrel, and wherein said  
15 plunger includes at least one an outwardly projecting part for engaging said projecting member upon advancement of said plunger past a position for fully dispensing medication, for releasing said latch.

21. A retraction control unit for a retractable needle syringe comprising:  
20 a cylindrical spring retainer with a distal axial cantilever extension, inserted co-axially and locked within a barrel of a syringe;  
a plunger with a compressibly engaged resilient cap, one or more radial projections and a central channel, and capable of reciprocal linear movements, and inserted within said spring retainer clearing the cantilever;  
25 a needle holder slidably mounted in said central open channel of said plunger for movement between an advanced position in which a needle on the distal end of said needle holder projects from a distal end of said nozzle, and a retracted position in which said needle is retracted within said barrel;  
the distal axial cantilever extension of the said spring retainer retaining a  
30 compression spring wrapped around said needle holder, such that said needle holder passes distally through an opening in the said axial extension;

a proximal surface of said spring retainer having a stabilizer plate to support the needle holder and a deflectable anchoring plate that releasably holds the needle holder against an expansion force of the spring until it is radially deflected by the projections of said plunger, in response to a force that exceeds a fluid injection force.

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22. A needle retraction mechanism for a retractable safety syringe comprising:  
support means in the form of a hollow cylindrical tubular segment engageable to the internal surface of a syringe barrel by mechanical or chemical means and having an axially extending cantilever means with an opening on its distal surface for supporting  
10 biasing means in the form of a compression spring engaged with a needle holder, and a needle holder anchoring plate having needle holder retaining geometry preventing needle holder means from retracting from the support means and located on a surface of support means opposite of the cantilever means;

needle holder means with a needle at its distal end slidably engaged in the opening  
15 of said cantilever means for linear movements between an advanced position in which a needle on the distal end of said needle holder projects from a distal end of the syringe barrel, and a retracted position in which said needle is retracted within said syringe barrel;

plunger means with a compressably engaged elastic cap, and a central channel that clears the cantilever means and the needle holder means in the barrel for reciprocal linear  
20 movements to receive and inject medication from the syringe;

said plunger means having radially projecting ramps flanking said central channel and being advanceable to create a first pressure gradient to inject medicine through the needle and a second pressure gradient to compress a plunger-cap junction and the elastic cap so as to cause the plunger ramps to engage and displace the anchoring plate of the  
25 support means to disengage and retract the needle holder;

wherein said needle holder means is releasably engaged by said anchoring plate at a distal end of a retraction chamber of the barrel counteracting said compression spring and advancing the needle holder distally to define an operative mode of the syringe; and

wherein said support means are inseparable from the barrel in an operative mode  
30 but, when said anchoring plate is displaced, release the needle holder and needle within the barrel.

23. A syringe assembly, comprising:  
an elongated, tubular barrel having a hollow interior forming a hollow nozzle  
located at a distal end of said barrel and opening into the interior of said barrel;  
a plunger slidably mounted in said barrel and having a longitudinal open channel;  
5 a needle holder slidably mounted in said longitudinal open channel of said plunger;  
a latch for latching and unlatching said needle holder relative to said barrel; and  
a spring for retracting said needle holder in response to unlatching of said needle  
holder by said latch;

wherein said needle holder has a lateral arm which extends radially, wherein said  
10 latch releasably engages the lateral arm of said needle holder; and wherein said latch  
inseparably engages said barrel.

24 The syringe assembly of claim 23 wherein said latch is rotatably mounted  
on said barrel for rotary movement between a locking position and non-locking position  
15 relative to said lateral arm.

25. The syringe assembly of claim 25 wherein said latch has an inwardly  
projecting member extending through a wall of said barrel, and wherein said plunger  
includes an outwardly projecting part for engaging said inwardly projecting member upon  
20 advancement of said plunger past a position for fully dispensing medication for releasing  
said latch.

26. The syringe assembly of claim 23 wherein said barrel has a cross section  
that is generally circular.

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27. The syringe assembly of claim 23 wherein the barrel of the said syringe is  
cylindrical and circular in cross-section.

28. The syringe assembly of claim 25 wherein said plunger includes a portion  
30 for releasing engagement of said latch upon advancement of said plunger past a position  
for fully dispensing medication for releasing said latch.

29. The syringe assembly of claim 25 wherein a track slot is formed in a proximal wall portion of said barrel for receiving said lateral arm therethrough and guiding said lateral arm between a fully advanced position and a fully retracted portion, said latch being positioned for releasably engaging said lateral arm at a distal end of said track slot.

30. The syringe assembly of claim 25 wherein said longitudinal open channel of said plunger includes a detent for engaging and retaining said needle holder when in a fully retracted position.

31. The syringe assembly of claim 30 wherein said needle holder has a recess at a proximal end thereof for engaging said plunger detent.

32. A syringe assembly, comprising:  
 an elongated, generally cylindrical barrel having a hollow interior forming a hollow nozzle located at a distal end of said barrel and opening into the interior of said barrel,  
 a plunger slidably mounted in said barrel and having a longitudinal open channel;  
 a needle holder slidably mounted in said longitudinal open channel of said plunger;  
 a latch for latching and unlatching said needle holder relative to said barrel; and  
 a spring for retracting said needle holder in response to unlatching of said needle holder by said latch;

wherein said needle holder has a lateral arm which extends radially, and wherein said latch releasably engages the lateral arm of said needle holder; wherein said latch is located and configured so as to be activated by said plunger.

33. The syringe assembly of claim 32 wherein said latch has a lateral arm engaging portion for releasably engaging said needle holder lateral arm.

34. The syringe assembly of claim 32 wherein said plunger includes a portion for releasing engagement of said latch upon advancement of said plunger past a position for fully dispensing medication.



35. The syringe assembly of claim 34 wherein longitudinal walls of said plunger which define said longitudinal open channel include projecting release elements for engaging and radially displacing said latch so as to disengage said lateral arm engaging portion from said needle holder lateral arm upon advancement of said plunger past a position for fully dispensing medication.

36. A retractable needle pre-filled safety syringe assembly, comprising:  
 an elongated, generally cylindrical barrel having a hollow interior forming a hollow nozzle at the distal end of said barrel and opening into the interior of said barrel;  
 10 an elastic O ring seated adjacent the nozzle;  
 a plunger with an elastic piston that seals around an interior of the barrel and is slidably mounted in said barrel, said plunger having a longitudinal open channel;  
 a needle holder slidably mounted in said longitudinal open channel of said plunger for movement between an advanced position in which a needle on the distal end of said  
 15 needle holder projects from said nozzle and seals against said O ring and a retracted position in which said needle is retracted within said barrel;  
 a compression spring mounted around said needle holder and retracting the needle holder proximally when expanded and the needle holder projecting distally when the spring is compressed;  
 20 wherein a medicine chamber defined in said barrel is proximally sealed with the rubber piston abutting against the needle holder while a needle lumen closed by mechanical means seals the chamber distally.

37. The assembly of claim 36 wherein said nozzle has a male taper on its outer surface; and further including a needle protector with a mating female taper on an interior surface to form an air and water tight seal between the barrel and needle protector.

38. The assembly of claim 36 wherein a medicine chamber defined within said barrel is totally sealed and isolated from a retraction mechanism comprising the needle  
 30 holder and the compression spring.

39. The assembly of claim 36 wherein the needle protector is filled with a non-coring elastomer.

40. The assembly of claim 36 wherein the nozzle and needle protector are  
5 provided with mating luer tapers to securely lock the needle protector to the nozzle.

41. The assembly of claim 36 and further including a latch having an engaged position in which said needle holder is latched relative to said barrel to hold said needle holder in its advanced position against the urging of said spring, and a disengaged position  
10 in which said needle holder is unlatched relative to said barrel to allow said spring to expand in a proximal direction to move said needle holder to its retracted position.

42. The assembly of claim 36 wherein said latch is inseparably mounted to said barrel.  
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43. The assembly of claim 36 wherein a portion of the plunger of the prefilled syringe that projects proximally from the barrel is split and folded along side of the barrel to reduce the volume of the prefilled syringe, and can be unfolded for injection of the medicine from the prefilled syringe.  
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44. The assembly of claim 43 wherein the split and folded plunger is incapable of spontaneous movements so as to preserve the integrity of the volume of medicine in the barrel.

25 45. A retractable needle safety syringe assembly, comprising:  
a hollow generally cylindrical barrel, with a wider proximal segment and a distal hollow nozzle communicating with the barrel;  
a needle holder holding a hollow hypodermic needle mounted at a distal end and a side aperture in said needle holder communicating with the needle;  
30 a compression spring wrapped around the needle holder biasing said needle in a direction for retracting the needle;

a spring retainer located in the wider segment of the said barrel and supporting said compression spring;

a plunger slidably inserted in the barrel, and having an elastomeric piston at a distal end and a central cavity enclosing the needle holder and needle, the plunger having  
5 linear axial mobility in barrel independently of said spring and needle holder; and

a ring-like switch encircling the barrel and rotatably locked onto the barrel surface, and engaging with said needle holder to releasably compress the spring, said switch being inseparable from said syringe at least until release of said needle holder by said switch for retraction of the needle within the syringe assembly.

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46. The assembly of claim 45 wherein the switch is coaxial with the barrel.

47. A retractable needle safety syringe assembly, comprising:

a hollow generally cylindrical barrel, with a wider proximal segment and a distal  
15 hollow nozzle communicating with said barrel;

a needle holder holding a hollow hypodermic needle mounted at a distal end of the needle holder and a side aperture in said needle holder communicating with the needle;

a compression spring wrapped around the needle holder for biasing said needle in a direction for retracting the needle;

20 a spring retainer located in the wider segment of said barrel and supporting said compression spring;

a plunger slidably inserted in the barrel, and having an elastomeric piston at a distal end and a central open channel enclosing the needle holder and needle, the plunger having linear axial mobility in barrel, that is independent of said spring and needle holder;

25 a latch having an engaged position in which said needle holder is latched relative to said barrel to hold said needle holder in its advanced position against the urging of said spring, and a disengaged position in which said needle holder is unlatched relative to said barrel to allow said spring to expand in a proximal direction to move said needle holder to its retracted position;

30 said latch comprising a semicircular element engaged on the barrel, and having two radial projections entering with the barrel cavity and engageable by said plunger for releasing said switch upon over-advancement of said plunger;

wherein said barrel includes a track slot and wherein said needle holder includes a lateral arm extending laterally from said plunger open channel into said track slot, whereby said needle holder is guided by said track slot as it moves toward its retracted position;

5 and wherein a distal margin of the switch engages the needle holder arm to compress the spring and thereby retain the needle extended out through the nozzle, and wherein the switch is inseparable from said syringe assembly until the switch is released to retract the needle within the syringe assembly.

10 48. The assembly of claim 47 wherein the switch is coaxial to the barrel.

49. The assembly of claim 47 wherein said track slot is located in a proximal part of barrel to engage the needle holder arm for proximal linear retraction.

15 50. The assembly of claim 47 wherein the track slot in the barrel wall is covered and closed.

51. The assembly of claim 47 wherein the barrel has outwardly extending gripping flanges, and the switch has two vertical diametric extensions that engage and  
20 project through respective slots on the flanges of the barrel and permit radial movement of the switch to release the needle holder arm.

52. The assembly of claim 47 wherein the needle holder arm is released by an outward radial displacement of the switch in response to linearly advancing the plunger  
25 within the barrel.

53. The assembly of claim 47 wherein said plunger has a pair of elongate, parallel radially extending walls which define said central open channel for receiving and positioning said needle holder and said compression spring, and wherein each of said walls  
30 includes a projection positioned for engagement with said switch projection upon over-advancement of said plunger.

54. A retractable needle safety syringe assembly, comprising:

- a hollow generally cylindrical barrel having an increased diameter proximal segment and a distal hollow nozzle communicating with the said barrel;
- a hollow needle;
- 5 a plunger slidably arrested in the barrel and having a longitudinal open channel;
- a needle holder mounting said needle at a distal end thereof and slidably mounted in said longitudinal open channel of said plunger for movement between an advanced position in which said needle on the distal end of said needle holder projects from a distal end of said nozzle, and a retracted position in which said needle is retracted within said
- 10 barrel;
- a compression spring;
- a spring retainer located in said increased diameter proximal segment of said barrel and supporting said compression spring around said needle holder, said needle holder having a lateral port communicating with the hollow needle;
- 15 wherein said barrel includes a track slot and wherein said needle holder includes a lateral arm extending laterally from said plunger open channel into said track slot, whereby said needle holder is guided by said track slot as it moves toward its retracted position;
- an elastomeric piston at a distal end of the plunger;
- 20 a ring switch encircling the barrel and rotatably locked onto the barrel, distal to a pair of flanges and proximal to a pair of detents on the barrel surface, engaging with the arm of the said needle holder to compress the spring to bias the needle out through the nozzle, and inseparable from the syringe until the needle is retracted within the syringe assembly by release of the needle holder;
- 25 the nozzle of the syringe having a male taper on its outer surface; and
- a needle protector with a complementary female taper on a mating surface to form an air and water tight seal between the barrel nozzle and needle protector, whereby pneumatic and hydraulic forces caused by sealed fluids in the barrel prevent advance of plunger and inadvertent retraction of the said needle.

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55. The assembly of claim 54 wherein the barrel has a wider wall proximal segment defining said track slot.

56. The assembly of claim 54 wherein said slot is in a proximal part of barrel to engage the needle holder arm for proximal linear retraction.

5 57. The assembly of claim 54 wherein the slot in the barrel wall is covered and closed.

10 58. The assembly of claim 54 wherein the plunger has linear axial mobility independent of movements of the spring and needle holder.

15 59. A retractable needle safety syringe assembly, comprising:  
 an elongated, generally cylindrical barrel having a hollow interior forming a hollow nozzle located at a distal end of said barrel and opening into the interior of said barrel;  
 a plunger slidably mounted in said barrel and having a longitudinal open channel;  
 a needle;  
 a needle holder mounting said needle at a distal end thereof, and releasably coupled to the said barrel for movement between an advanced position in which a needle on the distal end of said needle holder projects from a distal end of said nozzle, and a retracted position in which said needle is retracted with said barrel;  
 20 a compression spring mounted around the needle holder biasing the needle holder in a direction for retracting the needle proximally when expanded;  
 said nozzle having a male taper on its outer surface with a needle protector with a mating female taper to form an air and water tight seal between the barrel and needle protector;  
 25 whereby fluids residing in the barrel preventing advance of the plunger to the distal end of the barrel and avoiding the retraction before the use of the syringe.

60. A retractable needle safety syringe assembly, comprising:  
 an elongated, generally cylindrical barrel having a hollow interior forming a hollow  
 30 nozzle located at a distal end of said barrel and opening into the interior of said barrel;  
 a plunger slidably mounted in said barrel and having a longitudinal open channel;

a needle holder receiving said needle at its distal end and slidably mounted in said longitudinal open channel of said plunger for movement between an advanced position in which said needle projects from a distal end of said nozzle, and a retracted position in which said needle is retracted within said barrel;

5        wherein said barrel includes a track slot and wherein said needle holder includes a lateral arm extending laterally from said plunger open channel into said track slot, whereby said needle holder is guided by said track slot as it moves toward its retracted position;

10        a rotatable ring switch that encircles said barrel and engages with the needle holder arm projecting from the barrel wall;

a compression spring mounted around the needle holder and assembled to the barrel and biasing the needle holder for retracting the needle proximally when expanded;

15        the nozzle having a male taper on its outer surface, and a needle protector with a mating female taper to form an air and water tight seal between the barrel and needle protector;

whereby the retractable needle syringe assembly is sealed at the nozzle by the needle protector, such that in an operative state the syringe contains a quantum of air to prevent accidental advance of the plunger and to avoid premature retraction of the needle and disablement of the syringe.

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61.     A retractable needle safety syringe assembly, comprising:

a hollow generally cylindrical barrel, with a distal hollow nozzle communicating with the barrel;

25        a plunger slidably inserted in the barrel, having a polymeric piston at the distal end, and a longitudinal open channel;

a needle;

30        a needle holder mounting said needle at a distal end thereof and slidably mounted in said longitudinal open channel of said plunger for movement between an advanced position in which said needle on the distal end of said needle holder projects from a distal end of said nozzle, and a retracted position in which said needle is retracted within said barrel;

a compression spring wrapped around the said needle holder;

a spring retainer located in the said barrel supporting said compression spring;  
 said plunger having linear axial mobility independent of movements of the spring  
 and needle holder.

a switch engaged on the barrel and having two radial projections entering within  
 5 the barrel cavity;

said plunger advancing the polymeric piston to make a surface contact of a piston  
 distal conical end with a conical interior end of barrel for injecting medicine through the  
 needle by minimal force applied to said plunger;

said plunger being movable with an additional applied force to advance distally  
 10 within a cavity formed in the rubber piston cavity and so as compress the elastic rubber  
 piston thereby additionally advancing distally within the barrel; and

a pair of plates projecting from the plunger engaging and radially displacing said  
 projections of the switch upon said additional advance, so as to displace the switch  
 radially outwardly causing the release and retraction of the needle holder.

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62. The assembly of claim 61 having a barrel with proximal wider segment that  
 accommodates a spring retainer.

63. A retractable needle safety syringe assembly, comprising:  
 20 an elongated, generally cylindrical barrel having a hollow interior forming a hollow  
 nozzle located at a distal end of said barrel and opening into the interior of said barrel;

a plunger slidably mounted in said barrel and having a longitudinal open channel;  
 a needle;

a needle holder slidably mounted in said longitudinal open channel of said plunger  
 25 for movement between an advanced position in which said needle, held on the distal end  
 of said needle holder, projects from a distal end of said nozzle, and a retracted position in  
 which said needle is retracted within said barrel;

a compression spring mounted around the needle holder and assembled to the  
 barrel, and biasing the needle holder in a direction for retracting the needle proximally  
 30 when expanded;



said needle having an open proximal end mounted in and sealed by adhesives to a distal dead end of the needle holder such that the open proximal end of the needle is not exposed to air in the barrel;

an entry and exit hole for medication located in a lateral wall of the needle holder  
 5 and in communication with said needle, that is a boundary zone of zero velocity and is only affected by a pressure gradient in the barrel and not by retraction of the needle;

said needle holder having a larger cross-section at its proximal portion which adds significant mass to dampen the retraction velocity of the needle holder, and wherein the expansion spring is always in contact with the needle holder to provide minimum recoil to  
 10 needle and its contents.

64. A retractable needle safety syringe comprising:

an elongated, generally cylindrical body forming an aperture at the distal end of said cylindrical body and opening into the interior of said cylindrical body;

15 a needle holder carrying a hollow hypodermic needle projecting from said holder along the axis of said cylindrical body, said needle holder being mounted for longitudinal movement between retracted and advanced positions within said elongated cylindrical body;

a releasable latch for releasably locking said cylindrical body and said needle  
 20 holder to each other;

biasing means within said cylindrical body for biasing said needle holder toward said retracted position;

a plunger carrying said needle holder and mounted for longitudinal movement between retracted and advanced positions within said elongated cylindrical body, said  
 25 plunger being movable to a first advanced position in response to an applied manual force of a first magnitude, and to a second advanced position in response to an applied manual force of a second, greater magnitude; and

means for releasing said latch in response to movement of said plunger to said second advanced position, so that said needle holder is retracted by said biasing means  
 30 upon movement of said plunger to said second advanced position.

65. The syringe of claim 64 which includes a resilient, compressible piston on the distal end portion of said plunger.

66. The syringe of claim 65 wherein an interface between said piston and said  
5 end portion of said plunger is formed to permit said plunger to advance further by  
compressing said piston after said piston has bottomed out on a distal end of the interior  
of said cylindrical body.

67. The syringe of claim 64 wherein said piston includes a substantially flat  
10 surface on a proximal end thereof, and said plunger includes a substantially flat annular  
flange engaging said substantially flat surface on said piston.

68. A retractable needle safety syringe comprising:  
an elongated, generally cylindrical body forming an aperture at the distal end of  
15 said cylindrical body and opening into the interior of said cylindrical body;  
a needle holder carrying a hollow hypodermic needle projecting from said holder  
along the axis of said cylindrical body, said needle holder being mounted for longitudinal  
movement between retracted and advanced positions within said elongated cylindrical  
body;  
20 a plunger carrying said needle holder and mounted for longitudinal movement  
between retracted and advanced positions within said elongated cylindrical body;  
biasing means within said cylindrical body for biasing said needle holder toward  
said retracted position; and  
a releasable latch for releasably locking said cylindrical body and said needle  
25 holder to each other, said latch having a latch body that extends at least partially around  
the circumference of said cylindrical body and is attached to said cylindrical body, said  
latch being movable between an engaged position in which said needle holder is latched in  
its advanced position against the urging of said biasing means, and a disengaged position in  
which said needle holder is unlatched to allow said biasing means to move said needle  
30 holder to its retracted position.

69. A retractable needle safety syringe pre-filled with a liquid to be administered to a patient, said syringe comprising:

an elongated, generally cylindrical barrel of biocompatible thermoplastic forming a medicine chamber traversed by an axial biocompatible needle holder with a hypodermic  
 5 needle attached to its distal end, and retained in the chamber by a reversible interlock of said barrel with said needle holder;

said needle holder being mounted for longitudinal movement between retracted and advanced positions within said elongated cylindrical barrel;

a releasable latch for releasably locking said cylindrical barrel and said needle  
 10 holder to each other;

a compression spring within said cylindrical barrel for biasing said needle holder toward said retracted position;

a plunger carrying said needle holder and mounted for longitudinal movement between retracted and advanced positions within said elongated cylindrical barrel, the  
 15 distal end of said plunger including a resilient piston which seals against an internal wall of the barrel;

wherein said needle holder is sealed by an "O" ring at a distal nozzle formed on said barrel, while the needle is also mechanically closed by a luer locked needle protector at the nozzle,

20 wherein proximally, the barrel including the needle holder is sealed by the resilient piston;

the plunger having a channel that permits an advance of the plunger for injection of medicine as well as retraction of the needle holder and the needle within the barrel when the medicine has been injected, and the latch has been released;

25 wherein the integrity of needle holder location and the retraction and locking of the needle holder in the barrel is achieved by the compression spring installed on a spring retainer and engaged with the needle holder; and

wherein sealing of the medicine chamber prior to injection of the medicine is additionally supported by the spring retainer.

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70. A retractable needle safety saline filled syringe assembly for intravenous catheter placement, comprising:

an over-the-needle catheter comprising a flexible polymeric tubular catheter having a mounting connector with a female luer taper;

a hollow generally cylindrical barrel and a distal hollow nozzle communicating with said barrel, and having male luer taper on its outer surface that engages with said female luer taper of the over-the-needle catheter to thereby mount the catheter on the nozzle;

a hypodermic needle mounted to a needle holder;

said catheter being coaxially installable over the hypodermic needle emerging out through the nozzle and extending beyond the tip of said catheter;

a compression spring wrapped around the needle holder and urging said needle holder toward its retracted position;

a spring retainer element having a spring support portion extending interiorly in the center of the barrel and supporting a distal end portion of the compression spring encircling the hypodermic needle, while permitting the passage of the said hypodermic needle through the compressed spring and an opening in said support portion, through the nozzle and within said over-the-needle catheter;

a plunger slidably inserted in the barrel, having a resilient piston at its distal end, and a central cavity receiving said spring support, the spring and the needle holder;

said needle holder having a side arm at its proximal end which compresses the spring inside the spring retainer so as to cause said needle to project distally through the nozzle of the syringe and which is releasably attached to the barrel via a switch;

whereby in normal operative mode the saline filled syringe is used puncture the skin and a vein by the needle point to gain entry of the needle and the catheter into a vein, the hypodermic needle is retracted and the catheter remains on the nozzle for further advance and maintenance of fluid communication with said syringe for monitoring the location of the catheter and infusing fluids into the vein; and the hypodermic needle is retracted, while the flexible catheter is retained on the nozzle for non-traumatic manipulation and placement, and for monitoring the location of the catheter and fluid continuity through said catheter before connecting to intravenous fluid lines.

71. The assembly of claim 70 wherein the barrel has a wider proximal segment.

72. The assembly of claim 70 wherein a puncturing bevel point of said needle is exposed beyond the catheter while its female luer end is anchored onto the nozzle of the said barrel.

- 5 73. A retractable needle, single use syringe comprising:
- a hollow generally cylindrical barrel, with a wider proximal segment and a distal hollow nozzle communicating with an interior of said barrel;
  - a needle;
  - a needle holder mounting said needle at a distal end thereof and slidably mounted
  - 10 in said longitudinal open channel of said plunger for movement between an advanced position in which said needle projects from a distal end of said nozzle, and a retracted position in which said needle is retracted within said barrel;
  - a compression spring mounted inside said barrel and urging said needle holder toward its retracted position; and
  - 15 a plunger slidably inserted in the barrel said plunger, having an elastomeric piston at a distal end, said plunger having linear axial mobility independent of movements of the needle holder and spring;
  - a switch mounted to said barrel and having an engaged position in which said needle holder is latched relative to said barrel to hold said needle holder in its advanced
  - 20 position against the urging of said spring, and a disengaged position in which said needle holder is unlatched relative to said barrel to allow said spring to expand in a proximal direction to move said needle holder to its retracted position to disable the syringe and prevent reuse of the syringe;
  - axially spaced flanges and detents on said barrel;
  - 25 wherein the switch encircles the barrel and is locked onto the barrel, distal to the flanges and proximal to the detents on the barrel surface; said switch engaging with said needle holder to compress the spring and being inseparable from said barrel until the needle holder is released by the switch and the needle is retracted within the syringe.

- 30 74. The single use syringe of claim 73 wherein the expanded length of the spring exceeds the length of the needle, whereby the syringe is non-reusable once the needle holder is released and the needle is retracted within the syringe.

75. The single use syringe of claim 73 wherein the needle holder has a recess engageable with a detent located on a proximal portion of the plunger for locking the needle holder in its retracted position, whereby the syringe is non-reusable.

5

76. The single use syringe of claim 73 wherein the needle holder once retracted is non-removably locked with a margin of the proximal end of the barrel, whereby the syringe is non-reusable.

77. The single use syringe of claim 73 and further including a spring retainer for supporting a distal end portion of the spring inside the barrel wherein the spring retainer is locked within the wider proximal segment of the barrel between a shoulder formed thereby at a distal, narrower portion of the barrel and an internal elevated ring within the wider portion of the barrel, whereby the syringe is non reusable.

15

78. The single use syringe of claim 77 wherein the spring is locked between the spring retainer and the needle holder and cannot be taken out or recompressed, once expanded, whereby the syringe is non-reusable.

79. The single use syringe of claim 73 and further including a spring retainer element having a spring support portion extending interiorly of said barrel and supporting a distal end portion of said spring against expansion, said spring retainer also having a through opening for freely receiving said needle holder therethrough; and wherein upon retraction the spring retainer also engages a detent on the plunger and locks the plunger to the spring retainer, whereby the syringe is non reusable.

25

80. The single use syringe of claim 73 wherein the barrel circumference is rendered non deformable by projecting ribs on the plunger, whereby the needle holder cannot be removed and the syringe is non reusable.

30

81. The single use syringe of claim 73 wherein said barrel has outwardly extending gripping flanges, and one or more detent elements parallel to and axially spaced

from said outwardly extending gripping flanges, and said switch is mounted between said detent elements and said barrel flanges.

82. The single use syringe of claim 73 wherein, upon retraction of the needle,  
 5 every component of the syringe is directly or indirectly locked with every other  
 component of the syringe, such that the entire assembly is interlocked whereby the syringe  
 is non-reusable.

83. The single use syringe of claim 73 wherein said barrel has outwardly  
 10 extending gripping flanges, and one or more detent elements parallel to and axially spaced  
 from said outwardly extending gripping flanges, and said needle holder locking element is  
 mounted between said detent elements and said barrel flanges; wherein said latch has an  
 inwardly projecting member extending through a wall of said barrel, and wherein said  
 plunger includes an outwardly projecting part for engaging said inwardly projecting  
 15 member upon advancement of said plunger past a position for fully dispensing medication  
 for releasing said latch.

84. A retractable needle safety syringe assembly, comprising:  
 an elongated, generally cylindrical barrel having a hollow interior forming a hollow  
 20 nozzle located at a distal end of said barrel and opening into the interior of said barrel;  
 a plunger slidably mounted in said barrel and having a longitudinal open channel;  
 a needle holder slidably mounted in said longitudinal open channel of said plunger  
 for movement between an advanced position in which a needle on the distal end of said  
 needle holder projects from a distal end of said nozzle and is sealed with an "O" ring, and  
 25 a retracted position in which said needle is retracted within said barrel;  
 a compression spring mounted around the needle holder and retracting needle  
 proximally when expanded, and a latch which at least partly encircles the barrel and  
 releasably engages with the needle holder to hold the spring in a compressed condition;  
 wherein said latch has an inwardly projecting member extending through a wall of  
 30 said barrel, and wherein said plunger includes an outwardly projecting part for engaging  
 said projecting member and disengaging said latch from said needle holder, upon

advancement of said plunger past a position for fully dispensing medication for releasing said latch;

wherein advancement of the plunger in a fluid-filled barrel generates a hydraulic pressure gradient that is relieved by the exit of said fluid from the needle such that any  
 5 increase in the hydraulic pressure in barrel as a result of an imbalance of generation and relief of the pressures tends to prevent rather than encourage retraction of the needle.

85. The assembly of claim 84 wherein said hydraulic pressure gradient prevents accidental retraction by preventing the contact between the projecting parts on  
 10 the plunger and on the latch.

86. The assembly of claim 84 wherein the spring and needle holder are located proximal to a polymeric piston mounted to a distal end of said plunger whose movements are responsible for generation of pressure and vacuum in the barrel and which is not  
 15 affected by pressure gradients within the barrel.

87. A syringe comprising:  
 an elongated, generally cylindrical body forming an aperture at the distal end of said cylindrical body and opening into the interior of said cylindrical body;  
 20 a needle holder carrying a hollow hypodermic needle projecting from said holder along the axis of said cylindrical body, said needle holder being mounted for longitudinal movement between retracted and advanced positions within said elongated cylindrical body;  
 a releasable latch for releasably locking said cylindrical body and said needle  
 25 holder to each other;  
 biasing means within said cylindrical body for biasing said needle holder toward said retracted position;  
 a plunger carrying said needle holder and mounted for longitudinal movement between retracted and advanced positions within said elongated cylindrical body, said  
 30 plunger being movable to a first advanced position in response to an applied manual force of a first magnitude, and to a second advanced position in response to an applied manual force of a second, greater magnitude; and



means for releasing said latch in response to movement of said plunger to said second advanced position, so that said needle holder is retracted by said biasing means upon movement of said plunger to said second advanced position, wherein said latch is located inside of said barrel.

5

88. A safety syringe assembly, comprising:

an elongated, generally cylindrical barrel having a hollow interior forming a hollow nozzle located at a distal end of said barrel and opening into the interior of said barrel;

a plunger slidably mounted in said barrel and having a longitudinal open channel,  
10 said plunger being movable to a first advanced position in response to an applied manual force of a first magnitude, and to a second advanced position in response to an applied manual force of a second, greater magnitude;

a needle;

a needle holder mounting said needle at a distal end thereof and slidably mounted  
15 in said longitudinal open channel of said plunger for movement between an advanced position in which said needle on the distal end of said needle holder projects from a distal end of said nozzle, and a retracted position in which said needle is retracted within said barrel;

a compression spring mounted inside of said barrel, and a spring retainer having a  
20 spring support portion extending interiorly of said barrel and supporting a distal end portion of said spring against expansion, said spring retainer also having a through opening for freely receiving said needle holder therethrough; said spring urging said needle holder toward its retracted position; and

a latch having an engaged position in which said needle holder is latched relative  
25 to said barrel to hold said needle holder in its advanced position against the urging of said spring, and a disengaged position in which said needle holder is unlatched relative to said barrel to allow said spring to expand in a proximal direction to move said needle holder to its retracted position, wherein said latch is an integral part of said spring retainer.

30 89. The syringe assembly of claim 88 wherein said latch is located in said hollow interior of said barrel.

90. The syringe assembly of claim 88 wherein said latch is mounted so as to be activated by said plunger.

91. The syringe assembly of claim 88 wherein the plunger has a projection that  
 5 irreversibly engages with the spring retainer when the plunger is in the second advanced position, whereby the syringe is non-reusable.

92. A safety syringe assembly comprising:  
 an elongated, generally cylindrical barrel having a hollow interior forming a hollow  
 10 nozzle located at a distal end of said barrel and opening into the interior of said barrel;  
 a plunger slidably mounted in said barrel and having a longitudinal open channel;  
 a needle holder slidably mounted in said longitudinal open channel of said plunger  
 for movement between an advanced position in which a needle on the distal end of said  
 needle holder projects from a distal end of said nozzle, and a retracted position in which  
 15 said needle is retracted within said barrel;  
 a spring mounted inside and barrel and urging said needle holder toward its  
 retracted position; and  
 a latch having an engaged position in which said needle holder is latched to said  
 barrel to hold said needle holder in its advanced position against the urging of said spring,  
 20 and a disengaged position in which said needle holder is unlatched from said barrel to  
 allow said spring to move said needle holder to its retracted position; wherein said latch is  
 inseparably mounted to said barrel, in said hollow interior of said barrel.

93. The syringe assembly of claim 91 wherein said latch is mounted so as to be  
 25 activated by said plunger.

94. The syringe assembly of claim 88 including a spring retainer element  
 mounted interiorly of said barrel and supporting a distal end portion of said spring against  
 expansion, and wherein said latch is an integral part of said spring retainer.

95. The syringe assembly of claim 94 wherein the plunger has a projection that irreversibly engages with the spring retainer when the plunger is in the second advanced position, whereby the syringe is non-reusable.

5 96. A safety syringe assembly, comprising:

an elongated, generally cylindrical barrel having a hollow interior forming a hollow nozzle located at a distal end of said barrel and opening into the interior of said barrel;

a plunger slidably mounted in said barrel and having a longitudinal open channel;

10 a needle holder slidably mounted in said longitudinal open channel of said plunger for movement between an advanced position in which a needle on the distal end of said needle holder projects from a distal end of said nozzle, and a retracted position in which said needle is retracted within said barrel;

a spring mounted inside said barrel and urging said needle holder toward its retracted position; and

15 a latch having an engaged position in which said needle holder is latched to said barrel to hold said needle holder in its advanced position against the urging of said spring, and a disengaged position in which said needle holder is unlatched from said barrel to allow said spring to move said needle holder to its retracted position;

20 wherein said latch comprises a needle holder locking element non-removably mounted to said barrel, in said hollow interior, and movable between a locking position and non-locking position relative to said needle holder.

97. The syringe assembly of claim 96 wherein said latch is mounted so as to be activated by said plunger.

25

98. The syringe assembly of claim 96 including a spring retainer element mounted interiorly of said barrel and supporting a distal end portion of said spring against expansion, and wherein said needle holder locking element is an integral part of said spring retainer.

30

99. A syringe assembly, comprising:

an elongated, generally cylindrical barrel having a hollow interior forming a hollow nozzle located at a distal end of said barrel and opening into the interior of said barrel;

a plunger slidably mounted in said barrel and having a longitudinal open channel;

a needle slidably mounted in said longitudinal open channel of said plunger and

5 having a radially projecting arm;

a latch for latching and unlatching said needle holder relative to said barrel; said latch engaging said radially projecting arm on said needle holder by which the needle holder engaged with the barrel, thereby releasably latching said needle holder relative to said barrel; and

10 a compression spring located in said barrel in surrounding relation to said needle holder and having a distal end held against expansion so as to expand in a proximal direction for retracting said needle holder in response to unlatching said needle holder by said latch; wherein said latch and said needle holder are at all times located in said hollow interior of said barrel.

15

100. The syringe assembly of claim 99 wherein said latch is mounted so as to be activated by said plunger.

101. The syringe assembly of claim 99 including a spring retainer element  
20 mounted interiorly of said barrel and supporting a distal end portion of said spring against expansion, and wherein said latch is an integral part of said spring retainer.

102. A syringe assembly, comprising:

an elongated, generally cylindrical barrel having a hollow interior forming a hollow

25 nozzle located at a distal end of said barrel and opening into the interior of said barrel;

a plunger slidably mounted in said barrel and having a longitudinal open channel;

a needle holder slidably mounted in said longitudinal open channel of said plunger;

a latch for latching and unlatching said needle holder relative to said barrel; and

30 a spring for retracting said needle holder in response to unlatching said needle holder by said latch;

wherein said needle holder has a lateral arm which extends radially, and wherein said latch releasably engages the lateral arm of said needle holder; wherein said latch and

said lateral arm of said needle holder are at all times located in said hollow interior of said barrel.

103. The syringe assembly of claim 102 including a spring retainer element  
5 mounted interiorly of said barrel and supporting a distal end portion of said spring against expansion, and wherein said needle holder locking element is an integral part of said spring retainer.

104. The syringe assembly of claim 102 wherein said latch is mounted so as to  
10 be activated by said plunger.

105. A syringe assembly, comprising:  
an elongated, generally cylindrical barrel having a hollow interior forming a hollow  
nozzle located at a distal end of said barrel and opening into the interior of said barrel;  
15 a plunger slidably mounted in said barrel and having a longitudinal open channel;  
a needle holder slidably mounted in said longitudinal open channel of said plunger;  
a latch for latching and unlatching said needle holder relative to said barrel; and  
a spring for retracting said needle holder in response to unlatching said needle  
holder by said latch;  
20 wherein said latch releasably engages said needle holder, wherein said latch is  
mounted so as to be activated by said plunger, and wherein said latch and said needle  
holder are at all times located in said hollow interior of said barrel.

106. The syringe assembly of claim 105 wherein said plunger being movable to  
25 a first advanced position in response to an applied manual force of a first magnitude, and  
to a second advanced position in response to an applied manual force of a second, greater  
magnitude, and means for releasing said latch in response to movement of said plunger to  
said second advanced position, so that said needle holder is retracted by said spring upon  
movement of said plunger to said second advanced position.

30

107. The syringe assembly of claim 105 including a spring retainer element mounted interiorly of said barrel and supporting a distal end portion of said spring against expansion, and wherein said latch is an integral part of said spring retainer element.

5 108. A syringe comprising:

an elongated, generally cylindrical body forming an aperture at the distal end of said cylindrical body and opening into the interior of said cylindrical body;

a needle holder carrying a hollow hypodermic needle projecting from said holder along the axis of said cylindrical body, said needle holder being mounted for longitudinal  
10 movement between retracted and advanced positions within said elongated cylindrical body;

a releasable latch for releasably locking said cylindrical body and said needle holder to each other;

15 biasing means within said cylindrical body for biasing said needle holder toward said retracted position;

a plunger carrying said needle holder and mounted for longitudinal movement between retracted and advanced positions within said elongated cylindrical body, said plunger being movable to a first advanced position in response to an applied manual force of a first magnitude, and to a second advanced position in response to an applied manual  
20 force of a second, greater magnitude; and

means for releasing said latch in response to movement of said plunger to said second advanced position, so that said needle holder is retracted by said biasing means upon movement of said plunger to said second advanced position, and means for locking said plunger in said second advanced position.

25

109. The syringe of claim 108 and further including a spring retainer element mounted interiorly of said barrel and supporting a distal end portion of said spring against expansion, and wherein said locking means includes cooperating elements located on said spring retainer element and on said plunger.

30

110. A syringe comprising:

an elongated, generally cylindrical body forming an aperture at the distal end of said cylindrical body and opening into the interior of said cylindrical body;

a needle holder carrying a hollow hypodermic needle projecting from said holder along the axis of said cylindrical body, said needle holder being mounted for longitudinal  
5 movement between retracted and advanced positions within said elongated cylindrical body;

a releasable latch for releasably locking said cylindrical body and said needle holder to each other;

biasing means within said cylindrical body for biasing said needle holder toward  
10 said retracted position;

a plunger carrying said needle holder and mounted for longitudinal movement between retracted and advanced positions within said elongated cylindrical body, said plunger being movable to a first advanced position in response to an applied manual force of a first magnitude, and to a second advanced position in response to an applied manual  
15 force of a second, greater magnitude; and

means for releasing said latch in response to movement of said plunger to said second advanced position, so that said needle holder is released by said biasing means upon movement of said plunger to said second advanced position, the nozzle of the syringe having a male taper on its outer surface and a needle protector with a  
20 complementary female taper on a mating surface to form an air and water tight seal between the barrel nozzle and needle protector, whereby pneumatic and hydraulic forces caused by sealed fluids in the barrel prevent advance of plunger and inadvertent retraction of the said needle.

25 111. A method of administering a medication, using a retractable needle, single use syringe, said method comprising:

applying a manual force of a first magnitude in order to move a plunger of the syringe to a first advanced position for dispensing medication;

applying a manual force of a second greater magnitude in order to move said  
30 plunger to a second advanced position for releasing a latch, so that a needle holder is released and retracted thereby permanently retracting a needle within a body of the syringe.

112. A method of administering a medication using a retractable needle, single use syringe, said method comprising:

- manually moving a plunger to a first advanced position in response to an applied
- 5 manual force of a first magnitude for dispensing said medication; and
- manually moving said plunger to a second advanced position in response to an applied manual force of a second greater magnitude for releasing a latch so that a needle holder is released and a needle is retracted within a body of said syringe.

10 113. A method of intravenous catheter placement using a retractable needle safety syringe assembly, said method comprising:

- installing a flexible polymeric tubular catheter on a syringe coaxially with a nozzle of the syringe and with a hypodermic needle projecting out through the nozzle and catheter;
- 15 puncturing of the skin and vein by a needle point to gain entry of the needle and the catheter in a vein;
- retracting said needle while said catheter remains on the nozzle for further advance; and
- maintaining fluid communication through said catheter and said syringe for
- 20 monitoring the location and infusing fluids in the vein; wherein said retracting includes manually moving said plunger to an over-advanced position in response to an applied manual force of a predetermined magnitude for releasing a latch so that a needle holder is released and the needle is retracted.

25 114. A method of dispensing a medication needle using a retractable single use syringe, said method comprising:

- manually moving a plunger to an advanced position for dispensing said medication, and retracting a needle of said syringe;
- said retracting including rotating a latch, that extends around at least a part of the
- 30 circumference of a cylindrical syringe body, and is attached to said cylindrical body from an engaged position in which a needle holder is latched in an advanced position with said needle extending from said syringe and a disengaged position in which said needle holder



is unlatched to allow a biasing means to move said needle holder to a retracted position wherein said needle is retracted within a body of said syringe.

115. The method of claim 114 wherein manually moving the plunger comprises  
 5 using a thumb for advancing the plunger to complete the injection of medicine and wherein said rotating comprises using said thumb to rotate said latch for retraction of the needle.

116. The method of claim 111 wherein the same hand achieves the injection of  
 10 medicine and retraction of the needle.

117. The method of claim 112 wherein the same hand achieves the injection of medicine and retraction of the needle.

118. The method of claim 113 wherein the same hand achieves the placement of  
 15 the catheter and retraction of the needle.

119. The method of claim 114 wherein the same hand achieves the placement of the catheter and retraction of the needle.

20

120. A method of intravenous catheter placement using a retractable needle safety syringe assembly, said method comprising:

installing a flexible polymeric tubular catheter on a syringe coaxially with a nozzle of the syringe and with a hypodermic needle projecting out through the nozzle and  
 25 catheter;

puncturing of the skin and vein by a needle point to gain entry of the needle and the catheter in a vein;

retracting said needle while said catheter remains on the nozzle for further advance; and

30 maintaining fluid communication through said catheter and said syringe for monitoring the location and infusing fluids in the vein; wherein said retracting includes rotating a latch, that extends around at least a part of the circumference of a cylindrical

syringe body and is attached to said cylindrical body, from an engaged position in which a needle holder is latched in an advanced position with said needle extending from said syringe and a disengaged position in which said needle holder is unlatched to allow a biasing means to move said needle holder to a retracted position wherein said needle is  
 5 retracted within a body of said syringe.

121. The method of claim 120 wherein the same hand achieves the placement of the catheter and retraction of the needle.

10 122. A retractable needle safety syringe assembly, comprising:  
 a hollow generally cylindrical barrel, with a wider proximal segment and a distal hollow nozzle communicating with the barrel;  
 a needle holder having a hypodermic needle mounted at a distal end thereof;  
 a compression spring wrapped around the needle holder;  
 15 a plunger slidably inserted in the barrel, and having an elastomeric piston at a distal end and a central channel enclosing the spring wrapped needle holder and needle, and having linear axial mobility in barrel independently of said spring and said needle holder;  
 a tubular spring retainer having a distal extension for supporting said compression  
 20 spring wrapped around the needle holder and biasing said needle in a direction for retracting the needle within the barrel, and a proximal extension plate having a projection that positively engages with the needle holder in the central channel of the plunger to maintain it in an advanced position in which a needle on the distal end of said needle holder projects from a distal end of said nozzle;  
 25 the wider barrel segment forming a distal support shelf for supporting the spring retainer and an elevated internal ring within the proximal segment of said barrel for proximally stabilizing the spring retainer;  
 said plunger advancing the piston to make a surface contact of a piston distal conical end with a conical interior end of barrel for injecting medicine through the needle  
 30 by minimal force applied to said plunger;  
 said plunger being movable with an additional applied force to advance distally within a cavity formed in the rubber piston cavity and so as compress the elastic rubber

piston thereby additionally advancing distally within the barrel, whereby a pair of plates projecting from the plunger disengage the proximal plate projecting over the needle holder causing the release and retraction of the needle holder.

5           123. A retraction control module for retractable needle safety syringe, said module comprising:

          a hollow cylindrical tube with a distal axial extension forming a central cantilever with a central through opening, and a proximal eccentric anchoring plate forming an engagement geometry to engage and anchor a needle holder to the module;

10           said needle holder having an advanced position in which a needle on the distal end of said needle holder projects from a distal end of said syringe, and a retracted position in which said needle is retracted within said syringe;

          a helical compressed spring encircling the needle holder and supported by said axial extension and the central cantilever with the needle holder and an attached needle  
15           passing through the central through opening of said cantilever, and within the tube;

          a plunger compressibly engaged with a resilient cap passing through said cylindrical tube and having two parallel walls defining a central open channel that contact with the eccentric anchoring plate without deflecting said anchoring plate;

          said plunger having a distally advanced position and ramps on said parallel walls  
20           which deflect the anchoring plate radially to disengage the needle holder and cause retraction of the needle when the plunger is advanced to said distally advanced position;

          said needle holder being slidably mounted in said central open channel of said plunger;

          said anchoring plate with extension arising from the opposite surface of the hollow  
25           cylinder from said distal axial extension and engaging with a proximal part of the needle holder preventing the expansion of said spring.

          124. The retraction control module of claim 123 wherein two halves snap together to complete cylindrical tube.

30

          125. The retraction control module of claim 123 which, when engaged to a syringe barrel, converts a conventional syringe into a retractable needle safety syringe.

126. The retraction control module of claim 123 wherein the cylindrical body is engaged to the barrel mechanically, chemically bonded or by physical means such as ultrasonic.

5

127. The retraction control module of claim 123 wheein when the anchoring plate is engaged with the needle holder, it urges the said needle holder distally exterior through the nozzle for normal use while when disengaged the expanded spring of the module urges the needle and the needle holder inside the barrel.

10

128. The retraction control module of claim 123 wherein said cylindrical tube has, on a proximal diameter opposite the anchoring plate, an extension plate that stabilizes the walls of the plunger inside the retraction control module.

15

129. The retraction control module of claim 128 wherein the extension plate has a detent that locks with a mating plunger detent on a posterior plunger flange, so as to engage and interlock the syringe.

20

130. The retraction control module of claim 123 wherein hydraulic forces in the syringe do not affect the retraction control module because it is outside a fluid chamber defined in the syringe.

25

131. The retraction control module of claim 123 where in the location of the retraction control module determines the volume of the medication taken in and injected and the length of the needle to be retracted.

132. A retraction control module for a retractable needle syringe, said module comprising:

a tubular module defining a cross-sectional geometry of a closed plane that fits within the barrel of a syringe by one of a mechanical fit, a chemical bond and an ultrasonic bond at a desired axial location;

30

said retraction control module having a central cantilever with a central opening arising from inside and at a distal surface thereof;

wherein said cantilever supports a compression spring wrapped around a part of a needle holder and locked between the cantilever and a proximal lateral part of the needle holder;

a plunger with a compressibly engaged elastic cap and a central channel;

a proximal surface of the tubular module having an anchoring plate juxtaposed to the plunger channel and having at one end a right angled bend towards the center to releasably engage a needle holder against the extensile force of a spring, so as to urge a needle out of the nozzle for a normal operative mode of the syringe;

said needle holder passing through the opening in the cantilever and having an axial linear mobility unless restricted by its engagement with the anchor plate of the said retraction control module or a detent in a proximal end of the plunger;

said plunger having linear axial movements within the retraction control module, and having triangular projections on flanges which define the central channel which just contact the anchoring plate to inject the contents of the barrel, and wherein, in response to the plunger when forced further, said projections displace the anchoring plate so as to release the needle holder and needle.